California and, the number of rail shipments would range from 512 to 1,464, depending on the mode (rail or heavy-haul truck) and corresponding corridor/route selected in Nevada. At most, 1,464 rail shipments would be made on the Jean heavy-haul truck route over 24 years. This equates to about 1 rail shipment every 6 days. However, DOE has identified mostly rail as its preferred mode of transportation, both nationally and in Nevada. At this time, however, the Department has not identified a preference among the five candidate rail corridors in Nevada.

Should a decision to proceed with the development of a repository at Yucca Mountain be made, shipping routes would be identified at least 4 years before shipments began. At this time, many years before shipments could begin, it is impossible to predict accurately which highway routes or rail lines DOE could use. Before such shipments began, states and tribes could designate alternate preferred highway shipping routes, and highways and rail lines could be built or modified.

Nonetheless, the representative highway routes identified for the EIS analysis conform to U.S. Department of Transportation regulations (49 CFR 397.101). These regulations, developed for transportation of Highway Route Controlled Quantities of Radioactive Materials, require such shipments to be on preferred routes selected to reduce the time in transit. A preferred route is an Interstate System highway, bypass, or beltway, or an alternate route designated by a state or tribal routing agency. Alternate routes could be designated by states or tribes under Department of Transportation regulations (49 CFR 397.103) that require consideration of the overall risk to the public and prior consultation with local jurisdictions and other states and tribes. Federal regulations do not restrict the routing of rail shipments. However, for the analysis, as discussed in Section J.1.1.3 of the EIS, DOE assumed routes for rail shipments that would provide expeditious travel and the minimum number of interchanges between railroads.

It is not possible at this time to determine the validity of the so-called "consolidated southern routing strategy." At present, DOE intends to purchase services and equipment from Regional Servicing Contractors who would perform waste acceptance and transportation operations. Section M.3 of the EIS contains more detail on the proposed role of the Regional Servicing Contractor. As discussed in Section M.3.2.1.2, the Regional Servicing Contractors would submit route plans to DOE for approval prior to their submittal to the Nuclear Regulatory Commission for approval. The route plans would most likely include more than one potential routing option for shipments from each waste generator site. These plans would be developed based on consultations with shippers, Federal, state, tribal, and local authorities, and application of U.S. Department of Transportation and Nuclear Regulatory Commission regulations. Among these, there could be southern and northern highway options. However, the actual route taken by a specific shipment would consider additional criteria as part of the shipment dispatching process, such as potential adverse weather conditions and construction delays. Therefore, it is not possible to predict whether the Regional Servicing Contractors would dispatch a higher volume of shipments to the southern east-west routes than more northerly east-west routes. Although one would expect the southern highway corridors to be less susceptible to adverse weather conditions than a more northern corridor, especially in winter months, the southern corridor would involve longer distances and longer transit times from the waste generator sites in the north-central and northeastern United States. The Regional Servicing Contractors would be tasked to develop procedures for dispatching the shipments as well as procedures for use by drivers and crews in making determinations on adverse weather and road condition operations. Section M.3.2.1.4 provides a discussion of the protocols and procedures that would be implemented by a Regional Servicing Contractor and its subcontractors under adverse weather or road conditions.

8.4 Transportation Casks

8.4 (25)
Comment - 53 comments summarized
Many commenters stated that full-scale field testing of shipping casks should be required and undertaken by the Department. Full-scale tests should reflect expected conditions during transport and not conditions limited by regulations of the Nuclear Regulatory Commission. Examples of conditions of transport include testing with spent nuclear fuel rods, diesel and gasoline fires in excess of 30 minutes and high temperatures, high-speed traffic accidents, train accidents and derailments, accidents in mountainous terrain, immersion in water, and sabotage with penetrating weapons. Some commenters stated that computer simulations should not be relied on, particularly since such modeling is inadequate for testing of nuclear weapons. If computer modeling is used, commenters said that modeling in excess of that required by the regulations should be conducted to determine failure thresholds.

Commenters questioned the reliability of testing on existing casks (use of quarter-scale models or only computer modeling), noting that only a very few casks are in use in the United States and that the recently licensed GA4/9 cask has not yet been manufactured. The EIS should clarify whether new or existing casks or preliminary cask designs were considered in the analysis.

Response
The NWPA requires that DOE use casks certified by the Nuclear Regulatory Commission when transporting spent nuclear fuel and high-level radioactive waste to a repository. The Commission certifies that a cask meets the requirements of 10 CFR Part 71, which prescribes radiological performance standards for casks subjected to specific test conditions. These test conditions represent the kinds of forces that a cask would encounter in a severe transportation accident. A cask's ability to survive the tests prescribed by 10 CFR Part 71 can be demonstrated in several ways. These options include component, scale-model, and full-scale tests to demonstrate or confirm the performance of the casks. As part of its detailed technical review, the Commission decides what level of physical testing or analysis is appropriate and necessary for each cask design. If the applicant for a certificate fails to demonstrate compliance with the regulations, the Nuclear Regulatory Commission would not issue a certificate. Therefore, if full-scale testing was necessary, it would be done before the Commission issued a certificate of compliance. For a more complete discussion of cask testing, see Section M.4, of the EIS. DOE has the option of evaluating the need for a full-scale cask test demonstration in the future.

At this time, the Nuclear Regulatory Commission does not require that shipping casks demonstrate their ability to withstand sabotage events as part of the certification process. The Nuclear Regulatory Commission has developed a set of rules specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. Known as physical protection and safeguards regulations (10 CFR 73.37), these security rules are distinguished from other regulations that deal with issues of safety affecting the environment and public health. The objectives of the physical protection and safeguards regulation are to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under control of unauthorized persons. The cask safety features that provide containment, shielding, and thermal protection also provide protection against sabotage. The casks would be massive. The spent nuclear fuel in a cask would typically be only about 10 percent of the gross weight; the remaining 90 percent would be shielding and structure.

It is not possible to predict whether sabotage events would occur, and if they did the nature of such events, nevertheless, DOE examined various accidents, including an aircraft crash into a transportation cask. The consequences of both the maximum reasonably foreseeable accident and the aircraft crash are presented in the EIS for the mostly truck and mostly rail transportation scenarios and can provide an approximation of the types of consequences that could occur from a sabotage event. In addition, DOE analyzed the potential consequences of sabotage against a truck or rail cask (see Section 6.2.4.2.3 of the EIS). The results of this analysis indicate that the risk of the maximally exposed individual incurring a fatal cancer would increase from approximately 23 percent (the current risk of incurring a fatal cancer from all other causes) to about 29 percent. The same event could cause 48 latent cancer fatalities in an assumed population of a large urban area.

Because of the terrorist attack of September 11, 2001, the Department and other agencies are reexamining the protections built into their physical security and safeguards systems for transportation shipments. As dictated by results of this reexamination, DOE would modify its methods and systems as appropriate.

For the EIS, the analysis assumed that the radiation emitted from casks would be within regulatory limits. To determine the number of shipments to be used in the analyses, DOE used the CALVIN computer program. The CALVIN program estimated the number of shipments by using a collection of different kinds of rail and truck shipping casks, including currently existing or designed casks, and matching these to the characteristics of the fuel to be shipped by each generator and the cask handling capabilities of the generator's site. (See Table J-3 of the EIS.)

8.4 (115)
Comment - 37 comments summarized
Commenters expressed concerns that the shipping casks analyzed in the EIS were not yet designed, tested or fabricated, and therefore the environmental analyses were incomplete or erroneous. Design criteria and materials requirements are unknown, and manufacturing equipment is unavailable or has not been developed. Other commenters addressed the inability to preclude human error in the manufacturing process, and the lack of known

and experienced cask manufacturers and experienced workers. Others questioned whether it would be possible to manufacture casks that would be “flawless” (not leak) and could withstand extreme temperature changes. The elimination of the multi-purpose Canister program would expose workers to radiation during the transfer at the reactors, during shipping, and at the repository. Still others said that all manufacturing standards and requirements must be met; that manufacturing oversight is required; and that DOE should make a financial commitment for further research. Commenters provided examples of the problems with existing storage/transportation casks, and casks that have not been certified, requesting that DOE test and publish data on any proposed casks and seek public comment. Some commenters believe that shipping casks can safely transport spent nuclear fuel given the past safety record of the industry.

Response

The shipping casks DOE would use to transport these spent nuclear fuel and high-level radioactive waste would be massive and tough, with design features that complied with strict regulatory requirements that ensure the casks would perform their safety functions even when damaged. Numerous tests and extensive analyses have demonstrated that casks would provide containment and shielding even under the most severe kinds of accidents. In addition, since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 of the EIS presents consequences for accidents that could release radioactive materials.

Because shipping casks are passive devices, human actions are not necessary to maintain the safety functions of a cask once it has been properly loaded and prepared for shipment. Human factors could affect cask safety in the design, fabrication, maintenance, and preparation for use. Effective practices promoted by a safety culture, strong regulatory oversight, quality assurance, and industry and regulatory standards provide a high degree of assurance that shipping casks meet the performance requirements of the regulations of the Nuclear Regulatory Commission and U.S. Department of Transportation. In addition, through continued commitment of resources to research and development, and development of consensus codes and standards, the Federal Government and private industry have contributed to ongoing improvement of cask safety.

At this time, many years before shipments could begin, it is impossible to predict with a reasonable degree of accuracy which shipping casks would be used. However, many casks are currently being built in the United States for the dual purposes of storage and transportation. As a consequence, fabricators are experienced in cask construction; other fabricators are familiar with construction of nuclear systems and components. DOE is confident that skilled workers and their companies are capable of doing the quality work expected for construction of these casks. As part of the certification of a cask design, the Nuclear Regulatory Commission requires a quality assurance plan that covers all processes and procedures for manufacturing the casks. This quality assurance plan is made part of the contract for the manufacture of casks. The cask owner and the Nuclear Regulatory Commission conduct inspections and audits of the manufacturer’s operations and implementation of their quality assurance plan and procedures to ensure that casks are built to meet certification requirements.

Transportation activities conducted by DOE would use casks certified by the Nuclear Regulatory Commission. The regulations, which must be met prior to certification, include radiological performance standards that ensure public health and safety. These standards are established and well known. Although DOE would use casks designed by others, the designs and applicable quality assurance activities would have to be certified by the Nuclear Regulatory Commission.

Although human error cannot be totally avoided, modern cask design practices, design certification, and compliance with approved quality assurance programs for all aspects of DOE’s transportation activities would limit the occurrence of human factor-based errors and mitigate their effects, should they occur. For example, in cask manufacturing the Nuclear Regulatory Commission regulations require a comprehensive quality assurance program in which measures must be established to ensure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements (see 10 CFR Part 71 Subparts D and H).

Transportation accident data (truck and train accident rates) provided by states and other government agencies for use in the analyses incorporates human error. These rates include human error as causes of the accidents as well as equipment failures that could be caused by human errors in manufacturing. Hence, human error was incorporated into the estimates of impacts of transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain. Additional detail on human error and accident rates is provided in Section J.1.4.2.2 of the EIS.

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site was recommended and approved. See the introduction to Chapter 8 of this Comment Response Document for more information.

8.4 (159)
Comment - 3 comments summarized
Several commenters expressed concerns about gas generation and pressure buildup in spent fuel casks and the potential for venting and hydrogen explosion. One commenter expressed concern about undetected defects in shipping casks.

Response
As discussed in Section 2.1.3.4 of the EIS, the casks that DOE would use to ship spent nuclear fuel and high-level radioactive waste would be certified by the Nuclear Regulatory Commission. Commission regulations at 10 CFR 71.43 do not allow casks to be vented during transportation. In addition, during transportation the containment cavities of the casks, which would hold the spent nuclear fuel, would not contain significant quantities of water or any other material that could be a significant source of explosive or pressurizing gas from radiolytic decomposition or chemical reaction. Nuclear Regulatory Commission and U.S. Department of Transportation regulations, and DOE Orders, as appropriate, would be in effect for all shipments. These regulations and Orders, which include quality assurance programs, would provide the level of safety oversight and monitoring necessary to ensure every cask was properly prepared for shipment.

Casks are robust structures composed of well Characterized materials that are assembled to form relatively simple and massive structures that are within the scope of current technology. Manufacture of the cask is accomplished using many standardized processes and the resulting cask's quality is ensured through application of the Nuclear Regulatory Commission's comprehensive quality assurance program, which covers fabrication of casks and requires that measures be established to ensure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements (see 10 CFR Part 71, Subparts D and H). The quality assurance program picks up systematic errors in the product and shuts down production and use of the casks if a problem is found. The Commission's oversight is independent of DOE's schedule and funding and can be expected to ensure that quality casks would be produced.

8.4 (199)
Comment - 6 comments summarized
Commenters said that the EIS should address additional variations in shipping casks, packaging options, materials and designs for waste packages, and multipurpose canisters. The EIS should also address the various shipping casks to be used and the spent nuclear fuel and high-level radioactive waste contents that will be shipped in each. Commenters suggested the EIS should assume that transport-only casks would be used and that only 68-metric-ton (75-ton), and not 113-metric-ton (125-ton) multipurpose casks, would be used. One commenter wanted the description of the packaging options to indicate that as-low-as-reasonably-achievable principles would allow some radiation to be emitted from packages.

Response
Because all casks must meet the same Nuclear Regulatory Commission and U.S. Department of Transportation safety performance standards for routine radiological exposures and behavior in severe accidents, the principal differences in casks for purposes of risk assessment are their weight, heat load capacity, and carrying capacity. These cask characteristics directly affect the number of shipments and type of transport vehicle.

Section 2.1.1.1 of the EIS discusses the range of packaging scenarios DOE is currently considering for packaging spent nuclear fuel and high-level radioactive waste for shipment and disposal. Section 5.2.2 discusses the design of disposal containers and waste packages being considered. Table J-3 lists and briefly describes 24 different types of shipping casks, including dual-purpose casks, and their projected contents assumed for the purpose of analyzing the potential impacts of shipping commercial spent nuclear fuel. Although other assumptions regarding cask sizes and contents are possible, DOE concluded that the assumptions used in the EIS are appropriate for estimating impacts of transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain. Section J.1.2.1.2 discusses the assumptions used in the EIS analysis for numbers of canisters of DOE spent nuclear fuel and high-level radioactive waste that would be transported in shipping casks.

Because the design and performance of shipping casks are strictly regulated and must be certified before use, DOE believes that the design details of casks that would not be used for many years are not needed to provide a reasonable estimate of the potential impacts in transporting spent nuclear fuel and high-level radioactive waste. Section 2.1.1.1 of the EIS explains the basis for DOE's selection of three packaging options.

DOE did not include a multipurpose canister option for legal-weight truck shipments because the quantity of spent nuclear fuel transported in a legal-weight truck cask is much less than the quantity that would be loaded into a disposal container. In addition, commercial storage casks that use multipurpose canisters for storage and transportation have capacities much greater than legal-weight truck casks. Designs of disposal containers, waste packages, dual-purpose and multipurpose canisters, other components, and operations of a geologic repository would implement the principle of reducing exposure to workers to levels that are as low as reasonably achievable.

8.4 (226)
Comment - 13 comments summarized
Commenters had general concerns about the shipment of spent nuclear fuel and high-level radioactive waste in casks. Commenters stated that casks are not safe and examples were cited of casks that had been broken in transit and of casks that had leaked. Others stated the casks had been inadequately tested and that every foreseeable risk should be eliminated so that there would be no danger of exposure to radioactive materials. Another commenter stated that spent nuclear fuel and high-level radioactive waste shipments are strictly regulated by the U.S. Department of Transportation and the Nuclear Regulatory Commission. This commenter noted that there have been nearly 3,000 shipments of spent nuclear fuel over the past 30 years, over which time there has never been a release of nuclear material due to a transportation accident. Another commenter believed that just because a cask had Nuclear Regulatory Commission certification, that was not a guarantee of good quality and cited examples from the nuclear powerplant located in the commenter's community. One commenter stated that the assumptions made in the Draft EIS related to cask permeability and potential for breach were very conservative and might have not been well thought through.

Response
In response to public comments, DOE has added Appendix M to the EIS, which presents information on cask safety (see Section M.4). DOE would be required to follow Nuclear Regulatory Commission and U.S. Department of Transportation regulations and use Commission Certified casks when transporting spent nuclear fuel and high-level radioactive waste to a repository. DOE is confident that by implementing these regulations and using Commission Certified casks, transportation would be carried out in a safe manner. Of the thousands of shipments completed over the last 30 years, none has resulted in an injury through release of radioactive material.

Shipping casks are robust structures composed of well-characterized materials that are assembled to form relatively simple and massive structures that are within the scope of current technology. Manufacture of the cask would be accomplished using many standardized processes and the resulting cask's quality would be assured through application of the Nuclear Regulatory Commission comprehensive quality assurance program. The program covers fabrication of casks and requires that measures be established to ensure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements (see 10 CFR Part 71, Subparts D and H).

Numerous tests and extensive analyses have demonstrated that casks would provide containment and shielding even under the most severe kinds of accidents. In addition, since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel and high-level radioactive wastefully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 of the EIS presents consequences for accidents that could release radioactive materials.

In addition, because spent nuclear fuel and high-level radioactive waste is in solid form, casks do not “leak” radioactive material as that term is commonly used. Instead, a release of radioactive material would involve a release of spent nuclear fuel particles, volatile elements, crud, and fission product gasses into the air.

8.4 (640)
Comment - EIS000141 / 0004
The DEIS also fails to consider unique local conditions along the potential truck route that could cause unacceptable safety and security risks for truck shipments using General Atomics GA-4/9 casks. Primarily a rural two-land highway with numerous steep grades and sharp curves, the route traverses high mountain passes subject to severe winter storms. Long segments (up to 60 miles) have no safe parking areas, few refueling facilities, and limited local emergency response capabilities. The Draft report assumes that almost all truck shipments will be made in the new GA-4/9 casks. The weight of the loaded GA-4/9 cask requires that it be used in conjunction with a specially designed trailer, a lower weight, cab-over-engine tractor, and a single fuel tank. DOE has failed to demonstrate that the GA-4/9 system is appropriately designed for a decades-long, nationwide shipping campaign to Yucca Mountain.

Response
The casks that DOE would use would be designed, manufactured, and operated in accordance with Nuclear Regulatory Commission requirements. These requirements apply to any cask and for any road or rail conditions, including those described in the comment. DOE is not limited to the GA4/9 casks for truck shipments. It could use any Commission-certified cask. The GA4/9 is attractive because of its advanced design and high capacity. The tractor-trailer designed for use with the cask was tested on a specially designed track. The transporter performed adequately in the test, which simulated about 400,000 kilometers (250,000 miles) of highway travel. Planning for shipments would consider route hazards, weather, logistics, and emergency response. For more information see Appendix M of the EIS.

8.4 (840)
Comment - EIS000173 / 0006
There is a problem of preventing criticality in a shipping cask, such as occurred in Japan last month due to an error made at a nuclear powerplant that injured many people, some critically.

Response
Preventing criticality in a shipping cask, as well as in any other system, structure, or component that handles spent nuclear fuel is a fundamental objective. The recent criticality accident that occurred in Japan did not involve spent nuclear fuel handling. The accident occurred at a processing facility. It was studied in depth by the Japanese government and international experts. The causes of the accident were multiple, but stemmed from inadequate training of operators and failure to follow approved procedures. DOE would ensure adequate training of its Federal and contractor staff. The Department would monitor all spent nuclear fuel handling activities at its facilities and ensure compliance with all safety requirements. The Nuclear Regulatory Commission standards for radioactive material shipping casks are found in 10 CFR Part 71. This ruling places limits on the amount of fissile material that can be loaded in a cask and stipulates that loaded casks remain subcritical even under conditions most favorable to

criticality. The criticality control systems for the cask are designed to maintain subcriticality for the most reactive contents permitted in a cask.

8.4 (1061)
Comment - EIS000289 / 0007
I can tell you that Radioactive Waste Management Associates in New York have presented me with facts about your casks that you have not. They are only built to withstand impact speeds of up to 30 miles per hour; and you admit to the fact they can only withstand temperatures of 1,400°, but diesel fuel burns at around 1,800°. And there was a famous fire that resulted from a truck accident in a tunnel that attained this temperature.

Response
The U.S. Nuclear Regulatory Commission requirements for transportation casks are described in 10 CFR Part 71. The requirements establish radiological performance standards for containment, shielding, and subcriticality that must be satisfied for cask designs when subjected to certain tests that represent the forces expected from normal and accident conditions of transportation. Included in the accident tests are a 9-meter (30-foot) free fall onto an essentially unyielding surface and exposure to a fully engulfing hydrocarbon fuel/air fire with an average temperature of 870°C (1,475°F). The 9-meter freefall does result in about a 48-kilometer (30-mile)-per-hour terminal velocity. However, hitting an unyielding target is significantly more severe than a 48-kilometer-per-hour traffic accident between vehicles, or between a vehicle and an ordinary stationary object. Similarly, an average temperature specification for a fire test adequately describes the range temperatures of visible flames of a hydrocarbon-air fire, which may range from 316°C to 1,112°C (600°F to 2,200°F). Although these accident conditions are called tests, analysis of the cask design is often sufficient to demonstrate compliance with regulatory performance requirements. Appendix M of the EIS provides additional information on cask testing and safety.

8.4 (1144)
Comment - EIS000087 / 0001
The truck drivers that transport this stuff have a limited amount of time they can be in front of these containers. Why? Because the containers leak. They do not provide containment.

If they were perfect, the truck driver would be able to be with his truck an unlimited amount of time each day. Therefore, we have a leaky container.

Response
Although the casks emit low-level radiation, they do not leak or release radioactive material, as implied in the comment. Spent nuclear fuel does emit gamma radiation and neutrons, which are largely absorbed by the massive cask. The shielding provided by the cask and distance reduces radiation levels near the cask to levels permitted by the Nuclear Regulatory Commission and the U.S. Department of Transportation. In accordance with those agency regulations, the dose rate around the cask can be no higher than 10 millirem per hour at 2 meters (6.6 feet) from the edge of the transport vehicle. The total dose received by all persons near the cask including crew and members of the public were estimated and are shown in Chapter 6 and Appendix J of the EIS. The maximum dose rate in the crew area permitted by regulation is 2 millirem per hour. Total annual radiation exposure to truck crews are limited by regulation.

8.4 (1575)
Comment - EIS000516 / 0003
Many activities were taken into account such as fire, puncture, accidents. But my question is, how hot of a fire? What kinds of lengths of heat burning would cause the casks to puncture? What will happen when the cask is immersed when combined with other possible factors such as falling off of a highway area into a river? What will happen when that's combined with high speeds with possibility of a fire?

Response
The Nuclear Regulatory Commission requirements establish radiological performance standards for containment, shielding, and sub Criticality that must be satisfied for cask designs when subjected to certain tests that represent the forces expected from normal and accident conditions of transportation (10 CFR Part 71). The regulatory tests for accident conditions are conducted sequentially. The sequence of tests is intended to represent the events expected in an accident (for example, impact, puncture, and fire). Although these accident conditions are called tests, analysis

of the cask design is often sufficient to demonstrate compliance with regulatory performance requirements. Appendix M of the EIS provides additional information on cask testing and safety.

8.4 (2458)
Comment - EIS000679 / 0004
Point number three: We suggested in the past they develop a variety of rail casks instead of the original. DOE was to make every reactor in the country use one big cask that half of them couldn't handle, this kind of the papa bear, mama bear, baby bear approach to cask design. Again they actually seemed to have listened to what they said, but there's so little detail in the Draft EIS that we can't tell what their small, medium, and large rail casks are all about.

Response
Because the specific casks that would be used for truck and rail shipments of spent nuclear fuel and high-level radioactive waste have not been designated, the EIS addresses the performance of generic cask designs in estimating transportation impacts. The important factors needed for this impact assessment are cask performance under normal and accident transportation conditions and cask capacity. Any cask DOE used would have to be certified by the Nuclear Regulatory Commission.

8.4 (2757)
Comment - EIS000859 / 0002
What if the canisters holding this material begin to leak? I know that an environmental impact study is being conducted; however, this study is assuming that these canisters are 100% safe. How can we know they are safe since we've never really used these casks for centuries at a time? I also know that the study is sponsored or directed by the same Department of Energy that is making the proposal. A study cannot prove that they are safe for a long period of time.

In the canister study, the tests conducted for a thirty foot free-fall seem hardly adequate. Trains and trucks often travel on bridges and overpasses, hills and mountains that are hundreds of feet high. What then? This nuclear waste will be coming from everywhere in the country, in some cases over 3000 miles. The risk is by far too great.

Response
Section 2.1.3.4 of the EIS discusses shipping cask manufacturing, maintenance, and disposal. For transportation, the reusable cask, not the spent nuclear fuel canister, provides containment. These casks are designed for service lives of 25 years or longer. During their service lives casks are continually monitored and maintained to ensure their performance level is adequate to protect public health and safety. Although the likelihood and consequences of releases of radioactive material from spent nuclear fuel casks are small, such risks and impacts are addressed in Section 6.2.4.2. The 9.1-meter (30-foot) freefall might seem inadequate when compared to the heights of some bridges and overpasses that a cask could encounter. However, hitting an unyielding surface is significantly more severe than hitting water, sand, hard soil, and even rock surfaces that could be encountered by a cask if such a drop occurred. Events were addressed in the EIS in determining that the risk of transporting spent nuclear fuel is low. Additional information about cask testing and safety is provided in Appendix M of the EIS.

8.4 (2787)
Comment - EIS000880 / 0004
How will DOE bound the number of shipments required to move waste from reactors to Yucca Mountain? Does the EIS assume that new, large rail and truck casks will be available and are these new casks realistic given the costs involved and the fact that DOE is now prohibited from engaging in cask design and production activities?

Response
As discussed in Sections 6.2.1 and 6.2.3 of the EIS, DOE considered a mostly truck and mostly rail scenario for the EIS. DOE factored casks now under development by private sector vendors into its analyses. As discussed in Section J.1.2.1, combining these modal assumptions with the amount of spent nuclear fuel to be shipped and the capacities of the truck and rail casks provides a good estimate of the numbers of shipments expected for the two scenarios. DOE believes that the mostly rail case, in which more than 95 percent of the spent nuclear fuel and high-level radioactive waste would be shipped by rail, would most closely approximate the actual mix of truck and rail shipments. Although DOE is no longer developing spent nuclear fuel casks, the private sector is. DOE plans to use these vendor developed, Nuclear Regulatory Commission Certified casks for its transportation activities.

8.4 (5205)
Comment - EIS001443 / 0029
It is recognized that the Nuclear Regulatory Commission has recently initiated a new program of cask testing which proposes to subject transportation cask prototypes to an expanded range of physical tests. Since the nature and, of course, results these tests are at present unknown and cask options cannot be evaluated via the NEPA [National Environmental Policy Act] process at this time, the current Yucca Mountain DEIS cannot be used as a base document from which to tier off a NEPA evaluation of possible cask designs. Further discussion of cask designs at this time is therefore unwarranted.

Response
DOE believes that the comment refers to the Package Performance Study (PPS), which the Nuclear Regulatory Commission (NRC) began at the end of 1999. This study will be similar to the Modal Study conducted for the NRC by Lawrence Livermore National Laboratory. Both studies address the performance of NRC-approved casks for severe "real-world" accidents. Accident events and situations considered in the PPS might result in tests and analyses of tests that are different from regulatory test conditions. This would be consistent with the scope of the PPS and would not suggest major changes to the current NRC transportation regulations in 10 CFR Part 71. Information on these studies is on the Sandia National Laboratories Internet site (*http://www.ttd.sandia.gov/nrc/modal.htm*).

The Nuclear Regulatory Commission revises its regulations periodically. The most recent revision in 1996 reflected changes in the international transportation regulations developed by the International Atomic Energy Agency that serve as a model for most national regulations. However, the changes to the Commission regulations are not of the magnitude suggested in the comment and will not affect the applicability of the EIS to meet National Environmental Policy Act requirements.

Information on cask safety and testing is provided in Section M.4 of the EIS. It is DOE's opinion that sufficient information on cask safety and testing is provided in the EIS to support current decisionmaking.

8.4 (5478)
Comment - EIS001660 / 0016
The DOE will change the design of the casks which would transport the HLW [high-level radioactive waste] and SNF [spent nuclear fuel] to the proposed repository at Yucca Mountain. The DEIS does not address whether the new design of the casks has been tested and analyzed. What is the integrity of die valves, seals, and shielding of the new designed cask? (Referenced information is at Attachment A - "Radiological Waste Management Associates" report.) Full scale cask testing is needed rather than computer simulations. [Following is text of reference.]

Use of "reference cask" containing a water jacket neutron shield

The Modal Study used as its reference cask one using a water neutron shield. This shield was assumed to evaporate in event of fire. The resulting dead air space was modeled to cut the heat transfer rate into the cask by over 70% (Modal 6-36). Given a 1475°F fire transferring heat at a rate of 17,000 BTU/hr-ft2, this had the effect of reducing the heat actually absorbed by the cask to 5,000 BTU/hr-ft2. This reduction was assumed when the melting times were calculated. However, newer casks no longer use water jackets, and the thermal insulation device assumed in the Modal Study is no longer present. Therefore, the heat transfer rate absorbed by the cask is expected to be much closer to the thermal output from the fire itself, since it cannot be assumed without testing that the polypropylene shield will behave like a water jacket. Since the time to reach lead melt is proportional to the rate of thermal input, the absence of the dead air insulator would have the effect of reducing the time required to melt the lead shielding from 1.09 hours to about 20 minutes. (Audin, 18) For the uranium and/or stainless steel shield, this means quicker increases in temperature than those postulated by the Modal Study, resulting in a reduction in the fire severity needed to cause a given accident condition.

"Lead cask bias" used to select most appropriate measurement parameter

The decision to use strain on the inner cask wall as the primary measure of cask response is based on lead's tendency to "slump" when subjected to high loading, resulting in high strains on inner cask wall. However, uranium and/or stainless steel are strong and rigid and thus will not slump. Rather, the force from impacts will be transferred to the joints and welds of the cask, likely resulting in a greater force being applied to them than those in a lead cask. The choice of strain as the sole measurement parameter for physical duress will likely lead to an underestimation of the damage caused to newer casks through rupture of welds and seals in the event of an accident. Therefore, new experiments must be performed to model this behavior.

Response
Section 6.2.4.2 of the EIS addresses transportation accident scenarios and the radiological impacts from accidents. DOE has revised the transportation analysis in the EIS to reflect new information. For example, since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates*. Based on the analysis in the report, DOE has concluded that the models used for analysis in the Draft EIS relied on assumptions that caused an overestimation of accident impacts. The radiological performance standards require that a design, in order to be certified, must provide radiological protection according to specified criteria for normal and accident conditions. The performance criteria are applied to containment, shielding, and sub Criticality. The performance standards are the same for any cask design.

8.4 (5825)
Comment - EIS001728 / 0003
Safe shipment containers [are] necessary. We believe that the current containers are of adequate design and have adequate testing and are safe for the general public. It goes through my mind there's a container that was in Europe that was put on a flat-bed truck, put across the railroad tracks, a locomotive and four cars hit that container at 100 miles an hour. The container was usable after that accident. I hate to say that I don't know of any other shipping container out there that would withstand that type of abuse; that the containers must be properly marked and properly identified such as under the requirements of the Department of Transportation; route plans which take into account interstate highways, bypasses, heavily populated areas and other such critical factors.

Response
Safety is DOE's primary concern when shipping spent nuclear fuel and high-level radioactive waste and, as stated in Section 2.1.3.2 of the EIS, DOE would comply with applicable regulations of the U.S. Department of Transportation and the Nuclear Regulatory Commission. The U.S. Department of Transportation and the Nuclear Regulatory Commission strictly regulate all aspects of spent nuclear fuel and high-level radioactive waste transportation including packaging; marking, labeling, and placarding; shipping papers; routing; prior notification; and training. More details on transportation regulations are in Section M.2. In addition, Section M.5 discusses cask safety and testing, including crash tests.

8.4 (6215)
Comment - EIS001017 / 0001
After the accident at Three Mile Island, public awareness of the dangers associated with things radioactive was heightened. In 1980, in order to allay public fears surrounding the transportation of radioactive waste, the Energy Department produced public relations films that purported to demonstrate the safety of casks used to transport the waste. The films show five full scale tests and conclude that the casks survived all the tests without releasing any radioactivity. Footage for the film was lifted from tests conducted and filmed at Sandia National Laboratories to check predictions on computers, not cask safety. The conclusions stated in the promotional film are contradictory to the results of the actual tests.

In 1992, a reporter from a Las Vegas TV station interviewed the scientists who conducted the tests. The project manager told the reporter that during the actual fire test a breach occurred in the cask and some of the lead from the cask squirted out through the hole into the fire. The lead was part of the radiation shield.

In the terrorist test, the reporter learned that when scientists shot a cask with a cannon or rocket, the projectile made a hole in the cask one inch in diameter and ripped through the fuel rods inside. The project manager said that the hole itself would have let out "some very small fraction of the contents of the cask." Yet the promotional film maintains that all the casks survived the tests without damage severe enough to jeopardize containment of their contents.

Critics say the tests conducted at Sandia are not really comparable with conditions encountered in the actual transport of casks. Marvin Resnikoff, in his book The Next Nuclear Gamble, cites a litany of misleading concepts and images and omitted facts.

The fuel used in the Sandia tests was fresh fuel. The amount of radiation given off by irradiated fuel rods is much greater than that given off by new fuel rods. The fuel rods had stainless steel cladding which is stronger than the brittle zircaloy currently used in reactor fuel. The casks used in the tests were obsolete and at least one was designed to a higher standard. The casks had lead radiation shielding. Most casks today use depleted uranium.

In the crash tests the cask was cushioned by the cab of the truck and other impact limiters. Many types of crashes would not afford such protection. Also many routine shipments do not incorporate as many impact limiters. Additionally, there are many crash scenarios which could exceed the cask certification requirements. Faulty valves or welds could fail in a fire or under the impact of a crash. Not all casks are secured by the type of tie downs used in the test. A cask secured with ordinary chains used in many routine shipments would have broken loose and hit the wall.

Pressure in the test casks was 26 pounds per square inch, lower than that of many casks. When filled with high-level waste the internal pressure can be from 300-355 psi [pounds per square inch] (Mark Dowie, Mother Jones, 7/82).

The narrator in the public relations video stated that no radiation would have been released in any of the tests, but in fact two of the Sandia tests resulted in leaks of water. If the pressure and temperature in the casks had been higher, as it would be from spent nuclear fuel, the amount of radiation released would have been greater, making it more dangerous for emergency crews. In the Sandia fire test, faulty welds caused the cask to crack at 100 minutes and the lead shield began to vaporize. The test was stopped. In the promotional film there is no mention of the crack. The narrator simply states that after 90 minutes the cask showed no damage. The Nuclear Regulatory Commission claims that the probability of exceeding the 1/2-hour fire in an accident has been studied and found to be small. However many accident scenarios such as a fire in a remote location or the piling up of many cars could result in fires lasting longer than 30 minutes. The Sandia fire tests were conducted at 1475°. Since the fire test was developed, combustible materials are routinely shipped which burn at temperatures up to 4,000°.

In the drop test a crack formed along a weld, forming a pathway for a leak. This was not mentioned in the promotional film.

Response

This comment covers several issues related to the interpretation by DOE of a film of tests performed at Sandia National Laboratories in the 1970s, as well as specific statements about the tests. Some of the latter statements offer interpretations of the tests that lack factual basis. Both types of comments are addressed in this response. For specific information on those tests, please consult the following documents:

- *Full-Scale Tests of Spent-Nuclear-Fuel Shipping Systems* (DIRS 157157-Yoshimura and Huerta 1976)
- *Crash Testing of Nuclear Fuel Shipping Containers* (DIRS 157098-Jefferson and Yoshimura 1978)
- *Analysis, Scale Modeling, and Full Scale Tests of a Truck Spent-Nuclear-Fuel Shipping System in High Velocity Impacts Against a Rigid Barrier* (DIRS 157096-Huerta 1978)
- *A Study and Full-Scale Test of a High-Velocity Grade Crossing Simulated Accident of a Locomotive and a Nuclear-Spent-Fuel Shipping Cask* (DIRS 157097-Huerta and Yoshimura 1983)
- *Analysis, Scale Modeling, and Full-Scale Test of a Railcar and Spent-Nuclear-Fuel Shipping Cask in a High-Velocity Impact Against a Rigid Barrier* (DIRS 157099-Huerta 1981)
- "Modeling of Pool Fire Environments Using Experimental Results of a Two-Hour Test of a Rail/Cask System" (DIRS 157110-Hamann et al. 1980)

DOE sponsored the testing performed at Sandia National Laboratories. The documentation for the tests (reports and films) is available to any member of the public. While the purpose of the tests was to confirm analytical models, the performance of the casks in conditions simulating severe accidents showed that the casks were very durable. They were not significantly damaged and continued to provide containment and shielding as required by Nuclear Regulatory Commission regulations. To suggest that the tests showed that shipping spent nuclear fuel in the casks would be “safe” was not an unreasonable interpretation of the test data.

In paragraph 2, the reply given to the reporter was correct. A crack in the outer skin of the cask resulted from expansion of the lead shielding after an intense fire, three times the duration of the Nuclear Regulatory Commission test fire. The crack released a small amount of lead before the fire was extinguished. The crack was a result of a manufacturing flaw that neglected to allow an expansion path for molten lead (which expands on melting) to flow into a volume provided for that purpose. The crack did not compromise the inner wall of the cask, which forms the containment boundary for the fuel.

The “terrorist test” referred to in the third paragraph was not part of the accident test series referred to earlier. The test was done in 1982. That test was not part of the film referred to earlier as the commenter suggests and the conclusion regarding the accident tests as quoted was correct.

The quote from Resnikoff in the fourth paragraph is correct. The Sandia National Laboratories tests did not mimic transportation conditions. Actual transportation conditions and accidents are much more benign than the accident environments provided in the tests.

The fifth paragraph deals with the fuel used. The facts are correct. The fuel was included to mimic the weight of spent nuclear fuel; it had no other role in the test. The higher temperature the cask might have achieved with real fuel would have had no effect on the results. The casks were lead shielded, as many are today and many would be for the shipping campaign to a repository. While the casks were no longer usable, they were designed to meet the same Nuclear Regulatory Commission standards in use today.

Most casks are equipped with impact limiters. Those in the Sandia National Laboratories tests were typical of the technology at the time. It is true that the truck cab did absorb some energy as it would in the real life high-severity accident situation modeled in the test. A recent report suggests that the assertion that “many crash scenarios could exceed cask certification requirements” is not correct (DIRS 152476-Sprung et al. 2000). Tiedowns in the Sandia National Laboratories tests met U.S. Department of Transportation requirements, but if the casks in both tests had no tiedowns, the results would have been the same. Little energy is absorbed in breaking the tiedowns. The role of tiedowns is keeping the cargo on the vehicle during incident-free transportation.

Paragraph seven of this comment suggests that the pressure in the casks in the Sandia National Laboratories test was lower than the 210,000 to 250,000 kilograms per square meter (300 to 355 pounds per square inch) said to be typical of high-level radioactive waste casks. During the 1970s, it was common practice to have water-filled casks to provide a cooling medium for the thermally hot, short cooled fuel for which the casks were designed. Because no heat rejection was needed for the surrogate fuel and the internal pressure was sufficient to force water from any leaks that might occur in the cask’s seals, there was no need for high pressure (though the pressure level suggested as typical for high-level radioactive waste casks seem to be higher than one might expect during the normal conditions of transportation).

Documentation of the Sandia tests indicates a small quantity of cooling waster escaped from the cask as stated in paragraph eight. The documentation indicates that the loss was not beyond that allowed by Nuclear Regulatory Commission regulations after the hypothetical accident test. The Sandia fire burned at temperatures exceeding 854°C (1,600°F); the 766°C (1,475°F) value is used for analysis and, together with other test conditions specified in the regulation, provides generally equivalent thermal input. The fire required for Commission certification must be fully engulfing (no view of the cask through the flames) for 30 minutes. The Commission assertion that this is not common is based on studies of fires that show that fires in accidents can be hotter and of longer duration, but they do not burn in one location and not with constant intensity as required in the test. As a result, the thermal input to the cask is seldom as high as achieved in the test.

The Sandia tests did not include a drop test as mentioned in the last paragraph of the comment, but if a crack appeared after a test for certification, it would likely result in a redesign of the package if it compromised containment. That is one of the functions of certification testing and analysis.

DOE has added Appendix M to the EIS to provide additional information on cask safety and testing.

8.4 (6556)
Comment - EIS001328 / 0012
NCSL [National Conference of State Legislatures] calls upon the federal government to: Proceed to develop dual-purpose (transportation and storage) and universal casks (transportation, storage and disposal) to reduce the handling of spent fuel and, thus reduce the risk of mishaps and lessen worker exposure.

Response
DOE would not develop transportation casks, but plans to contract with the private sector to provide waste acceptance and transportation services, including equipment. All cask designs must contribute to overall efficiency and operability of the entire transportation systems and meet Nuclear Regulatory Commission regulations. Information on the process for acquisition of waste acceptance and transportation services, including casks, through the Regional Servicing Contractors is provided in Appendix M of the EIS.

DOE did not include a multi-purpose canister option for legal-weight truck shipments because the quantity of spent nuclear fuel transported in a legal-weight truck cask is much less than the quantity that would be loaded into a disposal container. In addition, commercial storage casks that use multi-purpose canisters for storage and transportation have capacities much greater than legal-weight truck casks. Designs of disposal containers, dual-purpose and multipurpose canisters, other components, and operations of a nuclear waste repository will implement the principle of reducing exposure to workers to levels that are as low as reasonably achievable (ALARA).

8.4 (6559)
Comment - EIS001328 / 0011
NCSL [National Conference of State Legislatures] calls upon the federal government to: Consult with all affected parties regarding cask compliance with radiation emissions standards. Because cask integrity and safety is of paramount concern in a transportation system, all affected parties must be involved in a consultation process including, but not limited to, states, local governments, Indian tribes, carriers, labor, the Nuclear Regulatory Commission, the Department of Transportation, the Occupational Safety and Health Administration, the Federal Emergency Management Agency and the Environmental Protection Agency.

Response
The Nuclear Regulatory Commission has established and enforces the regulatory requirements for cask designs. All shipments would be made in Commission Certified casks. There would be various opportunities for states, tribes, and stakeholders to work and consult with DOE as the project moved forward to developing the transportation program. For more information, see Appendix M of the EIS.

8.4 (6925)
Comment - EIS001335 / 0003
The DEIS states that the cask design has been tested through simulation to withstand worse case scenario disasters, which includes withstanding a 30-minute all-engulfing fire at 800° Celsius and a 40 inch fall onto a 6-inch diameter steel rod. It is not hard for me to imagine a derailment on a section of multiple main track involving a coal train and a freight train moving in opposite directions at 50 mph less than 15 feet apart. The cask car containing the nuclear waste slams into the coal cars and is buried under 700 tons (10 cars) of coal, from 20 cars back the force of an additional 100 cars hurls two cars of propane, carrying 150,000 pounds of fuel each, into the pile of twisted metal and they ignite. Now you have an all-engulfing fire that won't burn for 30 minutes, but for 8 hours. The men and women and the two fire trucks of the Gibbon, NE Volunteer Rural Fire Department stand back and watch it burn, wondering how they will extinguish the pile of coal after the two tank cars burn themselves out. Hazardous material regulations should separate highly flammable cars from the cars containing nuclear waste lessening the potential for this type of incident but on February 8, 2000, a 120 Car freight left Lincoln, NE. and was 25 miles down the line when a failed equipment detector/car counter at Firth, NE. indicated two extra, unknown cars on the train. After all the paperwork was checked it was discovered that the unknown cars contained hazardous, flammable material.

I would like to emphasize that I am not being an alarmist, with the exception of the flaming tank cars in the derailment, these are all situations that I see on a daily basis. I'm sure if you wanted to check with the Federal Railroad Administration you could find more than one example of burning cars of hazardous material.

Response
In the EIS, train fires were assumed to burn for up to 11 hours, which exceeds the 8 hours cited by the commenter. As discussed in Section J.1.4.2.3 of the EIS, the rail accident data used in the transportation accident analyses were obtained from the Federal Railroad Administration and were for the period 1994 through 1996. These data include accidents involving hazardous materials fires. Information on cask safety and testing is provided in Section M.5.

As discussed in Appendixes J and M of the EIS, most real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask into a river, and similar extreme accident conditions, would not likely result in release of radioactive materials from the shipping casks. The performance standards for the casks prescribed by the Nuclear Regulatory Commission were selected to ensure that less than 1 percent of real-world accidents would result in loss of cask integrity and release of radioactivity from the cask. These standards ensure that the casks would be extremely robust.

8.4 (8016)
Comment - EIS000817 / 0067
P. 2-56 -- You say "one or more qualified companies that provide specialized metal structures, tanks, and other equipment would manufacture new shipping casks" -- just as "nonchalant" as that -- simple. -- I say, wait a minute. Have you looked at the track record of cask vendors? Do you know the problems? This is not just an easy thing. These are new designs -- untested, not time tested, and you expect it all to go like clockwork. Well, don't. The demand for casks is great and subcontractors are not used to nuclear QA. Did you ever hear of Sierra Nuclear and March Metalfab and that fiasco? Do you know of the faulty casks Pacific Nuclear sold DOE in Tru-pact agreements long ago? I mean who are we going to really trust to build these things?? And how do you really plan to verify shielding, structure, and heat transfer in these casks? How and when will O-rings be replaced? -- How are casks monitored en route? What if they "weep"? What is "minor cask maintenance," anyway? Has this been carefully thought out?

Response
Section 2.1.3.4 of the EIS addresses cask manufacturing, maintenance, and disposal. Although DOE does not know the specific companies who would build the casks used to transport spent nuclear fuel and high-level radioactive waste, casks have been successfully built and operated in the United States. As a consequence, many companies are experienced in cask construction and others are familiar with construction of nuclear systems and components. DOE is confident that skilled workers and their companies are capable of doing the quality work expected for construction of these casks.

Prior to issuing or renewing a certificate of compliance, the Nuclear Regulatory Commission must determine that a cask design complies with the requirements of 10 CFR Part 71, Packaging and Transportation of Radioactive Material. This regulation requires that an application for package approval be submitted to the Nuclear Regulatory Commission. This application is known as a "safety analysis report for packaging." The standard format and content guide for this application, Regulatory Guide 7.9, contains sections on structural evaluation, thermal evaluation, and shielding analysis. These analyses and evaluations are reviewed and approved by the Nuclear Regulatory Commission as part of the package approval process. The application must describe the maintenance program for the package, which would include the inspection of items such as O-rings.

Casks would be monitored using a satellite tracking system such as TRANSCOM. More details are provided in Section M.3.2.1.5 of the EIS.

The phenomenon of cask weeping can be described as follows: a cask that has been loaded or unloaded in a spent nuclear fuel storage pool becomes contaminated with radioactivity on its surface. Before shipment, the external surface of the cask is decontaminated to levels specified by regulations, but when the cask is inspected on arrival at its destination, contamination above the levels allowed by regulations is found. It is likely that when a cask is repeatedly placed into water-filled spent nuclear fuel storage pools, it becomes contaminated over time, with the contamination penetrating deeper into the pores of the cask body. The cleaning removes the surface contamination, but the contamination that is deep in the pores remains. During transportation of a loaded cask, the surface can become contaminated again as the deep contamination is driven out of the pores by the heat of the spent nuclear fuel.

The levels of contamination associated with the weeping phenomenon are not high enough to be factored into the risk assessment for transportation, and procedures would be used to effectively preclude this problem during shipments. For example, wrapping the cask in plastic before entry into spent nuclear fuel storage pools is an effective practice that is currently used. Therefore, weeping is not expected to be a significant contributor to risk during spent nuclear fuel transportation.

Minor cask maintenance consists of activities such as replacing seals, valves, and bolts that are identified during inspections. Additional information on cask testing and safety is provided in Appendix M of the EIS.

8.4 (8223)
Comment - EIS001021 / 0007
One thing the EIS definitely reinforces is that storage containers DO degrade, and there IS a measurable risk to the public from nuclear waste shipments to Yucca Mountain. The question is how fast does the damage occur and how much radiation exposure will there actually be?

Response
The degradation of storage containers is discussed in Sections K.2.1.1 and K.2.1.2 of the EIS. The results in Table K-1 show that storage canisters are breached within 500 to 5,400 years after the loss of institutional control.

The radiation dose from nuclear waste shipments is presented in Sections 6.2.3.1 and 6.2.3.2 of the EIS.

8.4 (8297)
Comment - EIS000817 / 0107
P. 4-88 Shipping Container -- depleted uranium and lead add to hazards in any accident and add to total waste at close of the repository. Why use these materials?

Response
Depleted uranium and lead are both used in spent nuclear fuel casks as gamma radiation shields. Depleted uranium is similar to natural uranium except that it has a lower concentration of the fissile isotope, U-235, than does natural uranium. Depleted uranium and lead are both very effective gamma absorbers. When used in a cask they would be fully encapsulated within the cask structure. The transport casks, which would contain the encased depleted uranium or lead gamma shields would be reusable. The spent nuclear fuel and high-level radioactive waste would be placed in waste packages, different from the transport casks, for deep geological disposal. At the end of their useful life, casks would be decommissioned and would be sent to appropriate waste management facilities. The depleted uranium and lead used for shielding in spent nuclear fuel casks would not be added to the repository waste inventory.

8.4 (8396)
Comment - EIS002014 / 0002
There is gong to be at least one accident during the transportation of the casks to Yucca Mountain. The tests you have performed on the casks are not good enough. You were only using simulated nuclear waste so you don't know exactly what will happen. What if it is thrown 40 feet? You never tested it on that far of a distance. I am also concerned that if one of the casks is broken, radioactive waste could seep down into the water table contaminating our drinking water.

Response
The potential for an accident involving transportation of spent nuclear fuel and high-level radioactive waste to Yucca Mountain is discussed in Chapter 6 and Appendix J of the EIS. DOE recognizes that accidents would occur. The potential for a release of radioactive material is very small and is not expected to occur during the 24-year period of transportation. Of the thousands of shipments completed over the last 30 years, none has resulted in an identifiable injury through release of radioactive material. In addition, the radioactive material in the cask is in the form of gases or solids, not liquids. The mode of release would be a gas or particulate. The release would be

carried by the wind. Contamination of surface water would be by deposition of the particles, which would be relatively small amounts.

The Nuclear Regulatory Commission regulates the design, construction, use and maintenance of shipping containers or casks for shipments of spent nuclear and high-level radioactive waste. The casks must be designed to withstand a series of impact, puncture, and fire environments, thereby providing reasonable assurance that packages would withstand serious transportation accidents. Additional information on cask safety and testing is provided in Section M.4 of the EIS.

While no test has been done for a 12-meter (40-foot) drop of a spent nuclear fuel cask, all analytical tools that are shown to predict the results of a 9.1-meter (30-foot) drop and the results of tests at other speeds and orientations indicate that a 12-meter drop is not going to produce a leak path to the environment (see DIRS 152476-Spring et al. 2000).

8.4 (8643)
Comment - EIS000817 / 0195
P. J-52....DOE sort of says NRC [Nuclear Regulatory Commission] will make sure everything is OK and prevent anything like this. Are you kidding? This has all happened! Do you know the history of Sierra Nuclear and the VSC-24 and Transtor casks? Nonconformance after nonconformance -- fines and violations, QA [quality assurance] problems over and over, undocumented weld repairs, charpy testing not done right, cracks in side welds found in a loaded canister, more casks fabricated than NRC exemption allowed before certification, unloading procedure not ready, weld cracks in seal lid welds, a coating that causes exploding hydrogen that lifted up the lid on a cask they were loading in Wisconsin, requirement of UT testing on loaded casks already on the pad at Palisades, Pt. Beach and ANO because of weld cracks. Stop work orders and stop loading orders from NRC numerous times, vent holes too small for unloading procedures in some Palisades casks -- (have to be drilled larger in unloading), shims welded in around shield lid and no initial plan as to how to get them out, no soil testing at the Palisades pad until after casks were loaded and on it there -- (the EIS for the plant on bedrock was used for the pad on sand dunes!). Concrete for outer shell not mixed correctly, rebars put in wrong at ANO, equipment not calibrated correctly -- etc., etc., etc., etc. A real fiasco! And then BNFL [British Nuclear Fuels, Ltd.] buys them out and promises to do better. Do they? No! -- we have the mess at Trojan with coatings washing off and clouding the water so you can't see to load. And the repeated hydrogen burns at Palisades even after we were promised they knew how to vent the hydrogen safely. Then we have Nuhoms with too thin walls than specified, and we have the TN casks at Prairie Island where the resin wasn't treated according to specifications as I understand it -- dry cask storage has problem after problem. But do I think Yucca Mountain is better? No! for these problems will be hidden underground instead of on pads where we can repair and test and monitor them. If those VSC-24 casks were underground, you'd have had to haul them all back up again several times by now! Where is a vendor we can trust? Where is a time tested (over long term) cask? Where is spent fuel that has been checked after unloading a cask? I sure can't recommend any.

Response
Sections 2.1.1.1 and 2.1.3.4 of the EIS discuss repository waste package scenarios and shipping cask manufacturing, maintenance, and disposal, respectively. Although DOE does not know the specific companies who would build the shipping casks or repository waste packages used for spent nuclear fuel and high-level radioactive waste, casks have been successfully built and operated in the U.S. As a consequence, many companies are experienced in cask construction and others are familiar with construction of nuclear systems and components. DOE is confident that skilled workers and their companies are capable of doing the quality work expected for construction of shipping casks and repository waste packages.

Long-term testing of repository waste packages would be part of the Performance Confirmation Program for the repository, which is a program of tests, experiments, and analyses that DOE would conduct to evaluate the accuracy and adequacy of the information used to determine that long-term repository performance objectives have been met. More details on this program are provided in Section 2.1.2.4 of the EIS.

DOE would start monitoring and maintenance activities of the repository and the waste packages after the first emplacement of waste packages. These activities would continue through repository closure, and would include monitoring and inspection of emplaced waste packages, investigations in support of predictions of long-term repository performance, and retrieval of waste packages if necessary. This would ensure that repository problems were identified and not hidden underground.

Spent nuclear fuel has been shipped to various locations around the U.S. for examination. Most of this spent nuclear fuel currently resides at the Idaho National Engineering and Environmental Laboratory.

8.4 (9407)
Comment - EIS001888 / 0103
The quality of the report is flawed in fundamental ways. Sources cited by the report in Chapter 6 refer to reports that assumed the use of a Multi-Purpose Canister (MPC) system. The DOE has abandoned the MPC system as unworkable. Despite this, the DEIS uses references about the MPC design to support its conclusions even though they are not relevant for the proposed action described by the DEIS.

Response
None of the calculated environmental impacts of transportation accidents in Section 6.2.4.2 of the EIS, conclusions about the impacts, or decisions to be made from the EIS assumed the use of the multi-purpose canister system. For example, some information in the EIS was derived from previous evaluations of the system, such as *Health and Safety Impacts Analysis for the Multi-Purpose Canister System and Alternatives*. Section J.1.2.1.1 lists shipping cask configurations and their capacities. Note that some of the casks are designated dual-purpose. Information directly applicable to the cask configurations under consideration in the EIS (that is, accidents at commercial facilities during spent nuclear fuel loading operations for single-purpose casks) was taken directly from the study. The probability of a lift-handling accident involving a fuel assembly was estimated to be 0.0001 per handling operation (DIRS 104794-CRWMS M&O 1994), as reflected in Section 6.2.4.1. This estimate is applicable to fuel assembly handling by crane and is independent of the type of cask or canister into which the fuel assembly is being placed. Thus, the information extracted from the reference is relevant to the shipping cask configurations assumed in the EIS.

Adjustments were made to the information extracted from references in cases where bases for the studies were not consistent with the assumptions made in the EIS. For example, the reference listed above assumed a 30-year operational period for the repository. In the EIS, adjustments were made to account for the assumed 24 years of repository operation, where appropriate. There are many similar instances in which data as extracted from a reference and adjusted to account for different bases and assumptions. This is consistent with Council on Environmental Quality guidance and DOE policies and procedures. Each EIS reference has been reviewed in detail, a determination of its applicability has been made, and appropriate adjustments have been made where necessary. As a consequence, DOE believes there is an adequate technical basis for the conclusions presented in the EIS.

8.4 (9582)
Comment - EIS001888 / 0256
The greatest cause for concern is the absence of operational performance data for most of the complex packaging, handling and shipping equipment required to implement the Proposed Action and Modules 1 and 2. For example, the GA-9 transportation cask is one of the primary components of the waste handling system envisioned in the DEIS. However, that cask requires a special trailer to handle and transport. This trailer has not yet been constructed. As was noted in one of the reference documents supplied with the DEIS, only “preliminary sketches” exist. This problem is particularly acute for the heavy haul transportation proposal. No data are presented in the DEIS to support any conclusions about the safety of transporting a 125 ton cask twice daily at 25 mph on an urban bypass with posted speeds of 65 mph through Clark County. No past experience, transporting spent fuel is relevant to the proposed action because there is no operational performance data for the equipment used to handle the waste.

Response
Although the GA4/9 shipping cask is a new design, it has no design features that are new. The shipping cask consists primarily of a thick stainless steel cask body that provides the primary containment of the radioactive cargo. Closure lids are welded to the bottom of the cask body and bolted to flanges at the top. Double elastomeric O-ring seals are provided for the top lid. Aluminum honeycomb impact limiters are provided to absorb energy should an accident occur. Depleted uranium is provided for gamma shielding and a solid hydrogenous material is provided for shielding against neutron radiation. All of these features and materials have been provided in past shipping cask designs and DOE and Nuclear Regulatory Commission are confident that the computer modeling and testing that

has been conducted on the GA4/9 cask design accurately predicts the behavior and performance of the shipping cask under severe accident conditions.

In terms of operational characteristics, the GA4/9 is not significantly different than other spent nuclear fuel shipping casks. The cask is shipped horizontally and loaded vertically, incorporates an internal basket for supporting the spent nuclear fuel cargo, and is closed using double O-rings seals and a bolted closure. Nevertheless, commercial and DOE facilities would develop site-specific cask handling procedures and conduct dry runs of cask handling operations prior to loading actual spent nuclear fuel assemblies into the shipping casks. Therefore, based on operating experience with similar spent nuclear fuel shipping casks and requirements to develop site-specific procedures and conduct dry runs, DOE believes that the lack of operating experience with actual GA4/9 shipping casks is not an issue with respect to the transportation impact analysis.

The commenter was concerned about the trailers that would be used to haul the spent nuclear fuel shipping casks. Although the GA4/9 trailer is specially designed for the shipping cask, it is similar to other trailers used to haul concentrated heavy loads. The trailer meets the requirements of American National Standards Institute (ANSI) N14.30-1992, "American National Standard for Nuclear Materials – Semi-Trailers Used in the Highway Transport of Weight Concentration Radioactive Loads Design, Fabrication, and Maintenance." Modifications would be made to incorporate the devices necessary to secure the shipping cask to the trailer, but otherwise the trailer is little different than other trailers in use today for weight Concentrated loads.

On the other hand, the heavy-haul truck transportation systems are in conceptual stages of development. Preliminary design and engineering studies have been conducted [see "Road Upgrades for Heavy-Haul Truck Routes - Design Analysis" and "Yucca Mountain Potential Nuclear Waste Repository Supplemental Transportation Analysis" in CRWMS M&O (DIRS 155347-1999)] that identify potential upgrades for mitigating the potential impacts of the heavy-haul truck concept shown in Figure 2-33 of the EIS. DOE believes it has adequately demonstrated the feasibility of these alternatives and developed them sufficiently to support comparisons of alternatives and decisionmaking about transportation alternatives.

DOE agrees the mostly rail/heavy-haul truck mode in Nevada is unprecedented, with only the heavy-haul truck campaign in France as a close comparison. However, based on the analysis mentioned above, this mode of transportation is technically feasible and its costs are comparable to rail transportation. Furthermore, DOE believes adequate measures are available or can be developed to ensure the safety of heavy-haul truck shipments. Safety measures currently required for heavy-haul truck shipments include restricting travel to daylight hours and providing escorts in front of and behind the shipments to warn other drivers of the slow-moving vehicles. In addition, DOE proposes to upgrade candidate heavy-haul truck routes to enhance the safety of the heavy-haul truck shipments and other vehicles and drivers on the highway. With these and other safety measures in place, DOE believes the heavy-haul truck implementing alternatives can be conducted safely.

8.4 (9587)
Comment - EIS001888 / 0262
Cask Fleet

No safety performance data exist to provide the basis for a credible transportation risk assessment. How many casks will be built? How long will a cask be used? When will they be built? Once a design is selected, how will it be tested? Will the tests be full-scale or models? How many spare parts will be fabricated? When? When will they be tested? How will changes to cask design be performed? How will the Regional Service Companies (RSCs) manage the spare parts and the cask fleets? None of these questions are addressed by the DEIS.

Response
In the United States, more than 2,700 shipments of spent nuclear fuel have been made over the past 3 decades with no releases of radioactive material due to a transportation accident. About 90 percent of those shipments used truck casks and the remaining 10 percent used rail casks. Although different casks might have been used over that period, they all met the Nuclear Regulatory Commission design standards. Thousands of shipments have been made internationally with casks that are certified to the same standards that confirm the U.S. experience. This safety record for spent nuclear fuel transport in the United States is excellent and is consistent with the overall highway and rail accident data. Risk assessment accident data for commercial transportation has been used in conjunction with

analysis of cask performance to estimate risks associated with spent nuclear fuel transportation. The approach is appropriate and widely accepted in the risk assessment community as the basis for credible risk assessment.

For the purposes of the Draft EIS, details relating to logistics of cask operations are not important. The transportation system would be operated in compliance with Nuclear Regulatory Commission requirements in regards to operation and maintenance of the cask. These requirements would ensure that casks used in operating the system would meet the safety standards on which the Draft EIS analysis was based.

In response to comments, DOE added Appendix M to the EIS. This appendix presents additional details on transportation planned operations and the Regional Servicing Contractors; on cask design, safety and testing; emergency planning and response; and on liability concerns.

8.4 (9590)
Comment - EIS001888 / 0264
Fabrication Issues

In a film of cask tests made in 1977, a cask is shown engulfed in flame as part of the 30-minute fire test required for cask certification. Twenty minutes after the camera was turned off, having recorded an ostensibly successful test, the cask broke open due to a manufacturing defect. An under appreciated aspect of transporting SNF [spent nuclear fuel] is the high level of technical sophistication required to fabricate a waste cask. The challenge of fabricating casks on the massive scale required by the programs proposed by the DEIS is problematic at best and could be greatly complicated by short production schedules, sporadic program financing, and other considerations not mentioned in the DEIS.

The transportation cask is assumed to be the primary component ensuring the safety transportation of spent nuclear fuel. The slightest flaw in manufacturing casks could have a greater impact on safety than many other variables. Although it is not a traditional NEPA [National Environmental Policy Act] consideration, it is an important part of ensuring the safe transportation of waste and a discussion of cask fabrication issues should have been included.

Response
The commenter is correct in stating that the transportation cask is the primary component for assuring the public's safety. This is one of the primary tenets of the radioactive materials transportation regulations. The design of casks and process of certification that is outlined in regulation and carried out by the Nuclear Regulatory Commission is such that casks which do not meet the requirements do not get certified.

Casks do not, in general, show a high degree of technical sophistication, as suggested in the comment. They are a passive structure composed of well characterized materials that are assembled to form relatively simple and massive structures that are within the scope of current technology. Manufacture of the cask is accomplished using many standardized processes and the resulting cask's quality is assured through application of the Commission's comprehensive quality assurance program. The Commission's quality assurance program covers fabrication of casks and requires that measures be established to ensure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements (see 10 CFR Part 71, Subparts D and H). The quality assurance program picks up systematic errors in the product and shuts down production and use of the casks when a problem is found. The Nuclear Regulatory Commission oversight is independent of DOE's schedule and funding and would ensure that quality casks would be produced. The example quoted in this comment was related to a manufacturing defect in a cask that was: (1) too old to be covered by the Commission's quality assurance program; (2) not in any way a threat to containment of the spent nuclear fuel; and (3) so subtle that it was not detected until conditions existed that would be seen in fewer than 1 in 10,000 severe accidents (DIRS 152476-Sprung et al. 2000).

8.4 (10016)
Comment - EIS001932 / 0001
Many of the safety tests on the "packaged for shipment" casks are flawed. The NRC [Nuclear Regulatory Commission] regulations require casks to be able to withstand a fire of 1,475° F for 1/2 hour seems impressive, but it is inadequate for highway and rail conditions. Many hazardous [cargoes], as a result of an accident, burn at

temperatures in excess of 1,475° F and longer than 1/2 hr! Diesel fuel burns hotter, as does propane at 4,000° F, butane at 1,875° F. In fact, the average temperature of a highway accident fire is 1,850° F (with a range between 1,400° F and 2,400° F). In addition, I am concerned about the integrity of the pressure relief valves in case of fire. I also understand that the trucks will be carrying extra fuel to avoid fuel stops or [stopovers]. In the case of rail shipments, rail bed integrity on bridges or trestles over rivers seem particularly vulnerable. Either from terrorists or improper maintenance.

Response
Safety is DOE's primary concern when shipping spent nuclear fuel and high-level radioactive waste and, as stated in Section 2.1.3.2 of the EIS, DOE would comply with applicable regulations of the U.S. Department of Transportation and the Nuclear Regulatory Commission. The standards being questioned by the commenter are established by the Nuclear Regulatory Commission, not DOE. DOE will continue to rely on the Nuclear Regulatory Commission to verify the adequacy of these standards. For example, the design of pressure relief valves would be reviewed and approved by the Nuclear Regulatory Commission during the package approval process.

Because of the weight of the truck casks analyzed in the EIS, it is likely that the trucks would carry less than typically carried.

Adequate rail lines, crossings, bridges, and tunnels exist to support spent nuclear fuel and high-level radioactive waste transportation, which requires no special transportation infrastructure that is not necessary for the safe transportation of commodities in the United States.

More details on cask safety and testing, including crash testing, are provided in Appendix M of the EIS.

Section 6.2.4.2 of the EIS addresses accidents including acts of sabotage. Sabotage of rail infrastructure would yield consequences similar to those estimated for transportation accidents.

8.4 (11360)
Comment - EIS002242 / 0002
Now, in the 1970's I was asked to conduct some experiments to evaluate whether or not our analytical tools were accurate in predicting what would happen to these shipping containers in severe accidents.

The other thing that I wanted to do was to try to develop some understanding of the environment of a severe accident, so that we would have a better handle on how to analyze these things. These tests were conducted with public involvement. On the first test we had 900 people show up for the test. Everybody loves to see smashing and crashing. The first test involved a 60-mile-an-hour impact of a truck mounted-shipping cask into a 20-foot cube of reinforced concrete. 960 tons of it.

The second test we took the same cask, since it suffered no damage, and impacted it on another truck at 84 miles an hour -- that's roughly twice the kinetic energy. Again no problem. We did a series of five full-scale tests during the time I was with Sandia Labs -- we did a total of about 1500 tests involving transportation of these materials.

The result was, of these tests -- since the public was involved, I would get up in front of people and say here is what we are going to do, here is what we expect after the tests. They were free to go up and look for themselves. And in every single case we predicted the damage accurately. If there was any inaccuracy, we overpredicted the damage.

Response
This commenter shares his personal experience in conducting the test program at Sandia National Laboratories in the mid-1970s. That experience suggests to the commenter that the capability to estimate the upper limit of the results of a wide variety of accident scenarios exist. DOE agrees with this comment and points to the work by Lawrence Livermore National Laboratory (DIRS 101828-Fischer at al. 1987) and, more recently by Sandia National Laboratories (Sprung et al. 2000), in demonstrating analytical capability related to cask response and estimation of risk to the public. Additional information on cask safety and testing is provided in Section M.4 of the EIS.

8.4 (11480)
Comment - EIS002247 / 0008
And I would like to know what casks are currently NRC [Nuclear Regulatory Commission] certified and whether or not they have the Transcom system in them, or in the trucks that are carrying them.

Response
The casks DOE is considering would have a valid Nuclear Regulatory Commission certificate of compliance when shipments began. Examples of truck casks certified by Commission include the General Atomics GA-4, the NAC International NLI-1/2, the NAC International NAC-LWT, and the Transnuclear TN-8 and TN-9.

The TRANSCOM system is a device attached to a vehicle that monitors vehicle movement by satellite tracking. DOE would use such a tracking system to monitor shipments when shipping began.

Appendix M of the EIS provides information on the transportation casks, regulations, and the operational protocols including shipment monitoring.

8.4 (11579)
Comment - EIS002235 / 0002
There are questions as to the crash test studies that were performed on the casks as to whether they are adequate to withstand the rigors of our Cajon Pass.

Response
As discussed in Sections 6.2.4 and J.1.4 of the EIS, neither the EIS nor the Nuclear Regulatory Commission's (NRC) transportation regulations (10 CFR Part 71) address specific hazards on specific highways or railways. However, both address the types of hazards that could be encountered over highways and railways. Casks certified by the NRC for transportation are designed to perform their radiological protection functions under normal and accident conditions of transportation. These radiological protection functions ensure public health and safety. Section J.1.4.2 considers the likelihood and consequence of accidents for transportation of spent nuclear fuel in estimating risk. The likelihood or probability of the occurrence of an accident with specific characteristics is based on historic statistical behavior. The consequence of an accident with specific characteristics is based on engineering factors and the fact that casks used by DOE would be NRC-certified. Because of these considerations (statistically based accident rates and cask performance), the risks estimated for the EIS are expected to cover transportation of spent nuclear fuel anywhere in the United States, even over highways and railways that might have more severe conditions or be prone to higher than average accident rates. The conditions that exist at El Cajon Pass (long steep grades) are covered by the analyses in the EIS.

8.4 (11929)
Comment - EIS000817 / 0200
P. 6-29. And, frankly, seeing how the NRC [Nuclear Regulatory Commission] handled the VSC-24 fiasco, I have not a great deal of confidence in what they predict for cask performances either. NRC staff is overworked and can't handle the gigantic amount of problems that vendors and utilities have dropped in their lap dealing with cask certification and use. Every reactor wants casks; every vendor wants certification -- there is a big push by the industry to get everything done as fast and as cheaply as possible.

Exemptions to regulations and codes are handed out all over the place. This leads to trouble! Safety analysis documents are not current with what is really being done with casks as the procedures and designs are constantly changed by each utility. The "generic" cask has become a chameleon and is "site specific" at each location in the end. Also, the lack of communication between vendor, utility, and NRC on problems and troubleshooting has led to repeated problems that were not necessary. They could have been prevented. Workers don't even know when to call a fire a fire apparently when it comes to hydrogen flames vented from a cask. And then, at Palisades, they vented it through a flammable plastic tube attached to the machine by duct tape and was way too close to the cask. So it burned again! Do you really expect public trust when such stupid things go on with dry cask storage? And of course the mess at Trojan with Transtor was predictable -- but they did it anyway knowing full well the coating wasn't completely baked on as it was supposed to be. And other casks have problems too -- you know it. So don't act as if casks will work as expected. They won't.

Response
The Nuclear Regulatory Commission (NRC) is an independent agency of the Federal Government. NRC responsibilities include regulation of the Nation's civilian use of radioactive materials to ensure the protection of public health and safety. The NRC and its licensees share the responsibility for protecting public health and safety (DIRS 153561-NRC 2000). When the licensee fails to carry out its responsibilities to public health and safety, the NRC takes appropriate enforcement action. In the example given by the commenter, the NRC did that. The NRC learned of the problem and took appropriate enforcement action.

The NRC was established 25 years ago by the Energy Reorganization Act of 1974. The NRC record for regulating civilian use of radioactive materials is outstanding. DOE would use only Commission-certified casks for activities conducted under the NWPA. The Department is confident that the NRC will perform its mission, and the Department will uphold its responsibility for protecting public health and safety. Appendix M of the EIS provides additional information on applicable regulations and cask testing and safety.

8.4 (11980)
Comment - EIS002101 / 0014
Then you bounce them across our highways all the way out to here. All that corrosion's falling off of the casks. 750°, thousands of times background radiation emitting off of these things.

Response
Section 6.2.4.2 of the EIS addresses transportation accident scenarios and the radiological impacts from accidents.

Because of the strength and construction of a certified cask, it is not expected that a transportation accident could result in the ejection of spent nuclear fuel though the release of spent nuclear fuel would be a source of corrosion and large doses. The former would be a containment concern, the latter a shielding concern, since the shielding surrounds the containment vessel. The type of failure suggested would require large forces and cask designs that used brittle structural materials for their containment systems. The structural materials used in cask containment systems are characterized as ductile materials. Such materials, should they fail, would tend to stretch beyond their design limits, or in severe cases, tear. Although accident forces could be large, casks are designed with large safety margins to limit such stretching to meet regulatory requirements even for large accident forces. They are designed to preclude tearing or breaching of the containment system. Neither the forces possible in transportation accidents, nor the cask materials used, are consistent with the suggested scenario.

8.4 (12573)
Comment - EIS001887 / 0324
Page 6-31 to 6-32; Section 6.2.4.2.1 - Impacts from Accidents - National Mostly Legal-Weight Truck Scenario

Impact Issues Specific to Use of GA 4/9 Casks

The Draft EIS mostly legal-weight truck national transportation scenario fails to consider unique circumstances of the transportation system being evaluated. Specifically, the Draft EIS assumes that all shipments will be made in the new General Atomics GA4/9 truck casks, but fails to explicitly address aspects of the design and performance of those casks which may increase the probability and consequences of highway accidents.

Nevada's 1995 scoping comments requested that DOE consider the following issues. In order to achieve a four-fold increase in cask capacity, the GA4/9 casks utilize a number of new design features and materials. Further, the weight of the loaded GA4/9 cask requires that it be used in conjunction with a specially designed trailer, a lower weight cab-over-engine tractor, and a single fuel tank, in order to comply with legal weight limits. To date, there is no operating experience with spent fuel shipments in actual GA 4/9 casks, although DOE contractors have conducted operational tests using mock-ups. To our knowledge, no GA 4/9 casks have yet been manufactured under the recently issued NRC [Nuclear Regulatory Commission] certificate. The validity of the Draft EIS LWT [legal-weight truck] transportation risk assessment therefore rests entirely upon speculative assumptions about the performance of casks which have never been used.

Nevada believes the Draft EIS must demonstrate that the GA4/9 cask, trailer, and tractor system is appropriately designed for use in a decades-long, nationwide shipping campaign to Yucca Mountain. DOE's risk assessment must evaluate issues such as: the power and handling characteristics of the tractor relative to long hauls in mountainous terrain under winter driving conditions; noise and vibration levels within the cab, and the potential impacts on driver fatigue and increased probability of human error; and the constrained fuel capacity of the tractor, requiring refueling every 300 to 400 miles, which could may additional safety and safeguards risks. The performance of GA4/9 cask's depleted uranium gamma shield in high-speed collisions with relatively unyielding structures, and the vulnerability to terrorist attack with armor piercing weapons and commercial shaped charges, must specifically be evaluated.

Response

As stated in Chapter 6 of the EIS, all shipping casks used to ship spent nuclear fuel and high-level radioactive waste to Yucca Mountain would be certified by the Nuclear Regulatory Commission. These casks would meet the design, performance, and testing requirements in 10 CFR Part 71.

The shipping cask performance data used to estimate the radiological risks of transporting spent nuclear fuel are from the Nuclear Regulatory Commission report *Reexamination of Spent Fuel Risk Estimates* (DIRS 152476-Sprung et al. 2000). These data represent the best available information on the performance of shipping casks during accidents, including shipping casks that use depleted uranium shielding. In addition, the report *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* (DIRS 104918-Luna, Neuhauser, and Vigil 1999) evaluated shipping casks that use depleted uranium shielding.

In terms of operational characteristics, the GA4/9 is not significantly different than other spent nuclear fuel shipping casks. The cask is shipped horizontally and loaded vertically, incorporates an internal basket for supporting the spent nuclear fuel cargo, and is closed using double O-ring seals and a bolted closure. Nevertheless, commercial and DOE facilities would develop site-specific cask handling procedures and conduct dry runs of cask handling operations prior to loading actual spent nuclear fuel assemblies into the shipping casks. Therefore, based on operating experience with similar spent nuclear fuel shipping casks and requirements to develop site-specific procedures and conduct dry runs, DOE believes that the lack of operating experience with actual GA4/9 shipping casks is not an issue with respect to the transportation impact analysis.

The commenter was concerned about the tractors and trailers that would be used to haul the spent nuclear fuel shipping casks. Although the GA4/9 trailer is specially designed for the shipping cask, it is similar to other trailers used to haul concentrated heavy loads. The trailer meets the requirements of ANSI Standard N14.30-1992, *American National Standard for Nuclear Materials – Semi-Trailers Used in the Highway Transport of Weight Concentration Radioactive Loads Design, Fabrication, and Maintenance*. The tractor is commercially available and is used today for long hauls and to traverse difficult terrain under adverse weather conditions. The operating characteristics of the tractors and trailers are not significantly different than other load Concentrated shipments. Therefore, the power and operating characteristics of the tractor-trailer are adequately addressed in the transportation impact analysis. In addition, noise and vibration levels in the truck cab would be no different than other similarly designed truck-tractor combination vehicles and would not contribute any more to human error than other truck-tractor systems.

The transportation impact analysis incorporates the constrained fuel capacity of the tractor, which does not appear to DOE to be a source of additional safety and safeguards concerns. In terms of safeguards concerns, the shipments would meet the Nuclear Regulatory Commission requirements in 10 CFR Part 73. Stops, including refueling stops, are addressed in the route plans submitted to the Nuclear Regulatory Commission for approval. Appropriate safeguards and security provisions are specified during the preshipment planning process and are implemented for each shipment. See Appendix M of the EIS for additional information.

A number of activities are conducted to provide assurance that the shipping casks and vehicles are not deteriorating over time. The shipping casks are visually inspected for damage, their sealing surfaces and seals are inspected and replaced or repaired, and a leak test is performed prior to each shipment in accordance with operating procedures at the commercial, DOE, and Yucca Mountain sites. In addition, the fabricated casks are tested, including weld and hydrostatic tests, before they are placed in service. The shipping casks are subject to periodic inspections in accordance with the Certificate of Compliance issued by the Nuclear Regulatory Commission. Furthermore, periodic inspection and maintenance requirements for the vehicle (including in-transit brake, tiedown, and undercarriage inspections conducted by state agencies) provide assurance that the tractors and trailers used to haul the shipping casks are in proper working order. Further information on cask testing, operational protocols, and test and inspection procedures is provided in Sections M.4 and M.5 of the EIS.

8.5 Intermodal Transfer Facilities and Heavy-Haul Trucks

8.5.1 INTERMODAL FACILITY OPERATIONS

8.5.1 (180)
Comment - 8 comments summarized
Commenters said that the range of environmental, social, and economic impacts from the construction and operation of an intermodal transfer station was not adequately addressed in the EIS.

For the Caliente intermodal transfer station, commenters were concerned about the radiological risks to residents of Caliente because of the proximity of the facility to the city. Some wanted to know if the spent nuclear fuel and high-level radioactive waste would be repackaged at the facility, thereby increasing the risks of radiation exposure. Others said that this site is not an appropriate place to build such a facility. Some said that people in Caliente have already been adversely affected by the possibility of having an intermodal transfer station so close to the city and that citizens have become polarized just from the planning and decisionmaking associated with the facility. Others said that such a facility could adversely affect the lifestyle of residents. Commenters were concerned that businesses would not locate in Caliente because of the threat of constructing an intermodal transfer station or would move out if such a facility were constructed.

For the Sloan/Jean intermodal transfer station, commenters said that air quality and health impacts associated with this facility were not addressed in the EIS.

For the Apex/Dry Lake intermodal transfer station, commenters were concerned about the proximity of this facility to Las Vegas.

Response
Section 6.3.3 of the EIS discusses the impacts of Nevada heavy-haul truck implementing alternatives, including the impacts associated with an intermodal transfer station. The discussion indicates that, because spent nuclear fuel and high level radioactive waste casks would not be opened at the intermodal transfer station, the potential for accidents that could threaten the integrity of the casks is remote. These casks would be designed and certified by the Nuclear Regulatory Commission to withstand a range of severe transportation accident conditions, including collision impacts, drops, fires, and immersion in water. These conditions are much more severe than any expected at an intermodal transfer station. Therefore, the radiological risks from accidents to workers at an intermodal transfer station would be low, and the risk to the public from accidents at the facility would be negligible.

Section 6.3.3.1 of the EIS covers the impacts, including socioeconomic impacts, that would be common to the five heavy-haul truck alternatives. For example, it states that the total increase in employment (direct and indirect) that would result from construction of the intermodal transfer station, "… would peak in 2008 and would include about 135 workers. It also states that, "Increases in real disposable income from constructing an intermodal transfer facility would peak in 2008 at between about $2.7 million and $3.1 million." Air quality impacts common to operation of an intermodal transfer station at the Caliente, Apex/Dry Lake, or Sloan/Jean site are listed in Table 6-83. Health and safety impacts common to the alternative locations for an intermodal transfer station are listed in Tables 6–85, 6-86, and 6-87. Specific impacts associated with the construction and operation of an intermodal transfer station for each heavy-haul truck route analyzed are discussed in EIS Section 6.3.3.2.1 to 6.3.3.2.5. Radiological impacts to the health and safety of workers and persons living along transportation routes in Nevada, including impacts to persons who lived in the vicinity of an intermodal transfer station, are included in the results presented in Tables 6-93, 6-107, 6-112, and 6-117. The possible cumulative impacts from the operation of an intermodal transfer station at Caliente for shipments from the Proposed Action and shipments of low-level radioactive waste are discussed in Section 8.4.2.

In light of the comments received on the Draft EIS concerning perceived risk, DOE examined relevant studies and literature on perceived risk and stigmatization of communities to determine whether the state-of-the-science in